



Albuquerque, New Mexico 87108

MITSCOPE



MS 416 **FOUR CHANNEL
DIGITAL OSCILLOSCOPE
INSTRUCTION MANUAL**

Four Channel with Full Memory Capability

Battery or AC Powered

Hand-held Size

Digital Logic Oriented

.5 μ sec to .2 sec Time-base Range

All these are features found in an expensive piece of test equipment . . . BUT . . . they're also features found in the MITSCOPE MS-416 and it's a real moneysaver! This instruction booklet will teach you to use this most versatile tester!

CONTROL FUNCTIONS

PWR OFF/ON	Provides power to the unit
SYNC +/-	Provides selection of positive or negative edge triggering from Channel 1 input
MODE N/S	Provides selection of Normal or Storage mode of operation
TIME/DIV	Provides initial sweep-rate for display; also used to switch to automatic sweep
x1/x1000 (S4)	Increases time base by 10^3 factor
x1/x20 (S5)	Increases time base by 2×10^1 factor

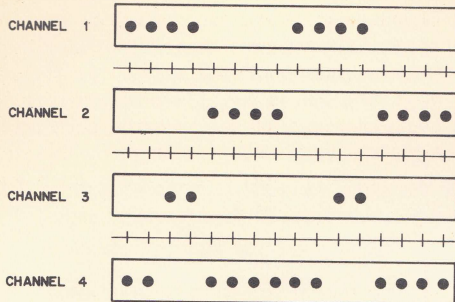
Application Notes The MS-416 is digitally oriented in design. Its primary function is differentiating between high (logic 1) and low (logic 0) voltage levels and noting their time relationships. The minimum voltage for a logic 1 is 2 volts; the maximum voltage for a logic 0 is 0.8 volts. The unit is best utilized for measuring square waves or pulses. However, any type of signal can be measured as long as you realize that only the parts of the signal within digital logic levels will be displayed.

The maximum input signal voltage must not exceed 5.5 volts. Exceeding this voltage may damage input buffer, IC B.

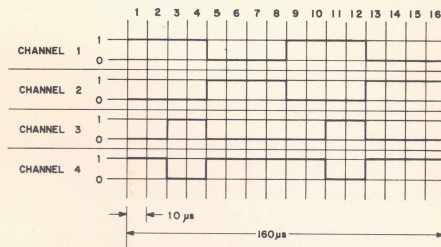
Interpreting The Display The information on the display of the MS-416 is interpreted in much the same manner as that on an ordinary oscilloscope. The setting of switches S4 and S5 and the position of the TIME/DIV knob determine the sweep rate.

As an example, assume the TIME/DIV knob is set to $5\mu\text{sec}$, S4 is set to "x1" and S5 is set to "x20". This means the display sweep rate is $10\mu\text{sec}$ per division. Each of the sixteen LED's in the channel represents one division.

Now assume that all four channels are being used and the display appears as follows:



This is what is being measured:



Channel 1 is high (logic 1) for $40\mu\text{sec}$, low (logic 0) for $40\mu\text{sec}$, high for $40\mu\text{sec}$ and low for $40\mu\text{sec}$. Channel 3 is low for $20\mu\text{sec}$, high for $20\mu\text{sec}$, low for $60\mu\text{sec}$, high for $20\mu\text{sec}$, and low for $40\mu\text{sec}$.

The signals are displayed, showing the logic levels and the respective time relationships between the signals.

Normal Operation The SYNC circuit of the MS-416 operates off the channel one input signal, so in both the normal and storage modes of operation, channel one must be utilized to trigger the sweep.

If the signal you wish to measure is of an unknown frequency, do the following:

- ..Set S4 and S5 to their "x1" positions.
- ..Set the MODE switch to the "N" position.
- ..Set the SYNC switch to either "+" or "-".
(depending on whether you want plus or minus edge triggering)
- ..Place the probe with the ground lead attached into the channel one (left-most) input jack. Connect the ground lead on the probe to a suitable ground on the circuit being tested.
- ..Set the power switch to ON. Be sure your batteries are fully charged or use the AC adapter and an AC power source.
- ..Place the probe on the point to be checked; then adjust the TIME/DIV knob until you get a meaningful display. If the entire channel on the display is lighted, the signal being tested is of a much lower frequency than the sweep rate.

- ..If the sweep rate is too high, set S5 to the "x20" position and adjust the TIME/DIV knob. If the entire channel continues to be lighted, switch S5 back to "x1" and set S4 to "x1000" and again, adjust the TIME/DIV knob. For the lowest possible sweep rate, set S4 to "x1000" and S5 to "x20" and adjust the TIME/DIV knob fully counter-clockwise.

If required, probes may be inserted in the other three channel jacks, enabling you to measure up to four signals simultaneously.

If a probe(s) is inserted in channel 2-4 jacks and not used, the appropriate channel on the display will be completely lighted.

If the signal frequency to be tested is known, do the following:

- ..Set S4 and S5 and the TIME/DIV knob to the correct sweep rate and use the appropriate multiplier(s) (x1, x20, x1000) to determine the display sweep rate.

Storage Operation The initial conditions for operation in the storage mode are the same as those for normal operation. At any point desired during normal operation, the MODE switch may be set to S and the unit will store the next sweep that appears on the display.

This information will be held and displayed continuously until the MODE switch is returned to N or until power to the unit is lost. If the display is difficult to read, the sweep rate can be adjusted even though the unit is in the storage mode; this adjustment can be made without affecting the time relationship. But if you adjust the sweep rate, make sure to note the initial setting so you may determine the actual time of the pulse. If necessary, the probes can be removed while the unit is in the store mode without affecting the display.

Pulse Catching A unique feature of the MS-416 is its ability to act as a pulse catcher in cases where it is necessary to observe a one-time occurring pulse. This is done by setting the desired sweep rate and the MODE switch to S prior to measuring the signal. When the signal occurs, it will be stored in the RAM (Random Access Memory) and will be displayed continuously. It can then be treated as a storage operation.

DC Steady State Measurement For the measurement of a continuous steady-state logic 0 or 1, the unit must be set for automatic sweep. This is done by means of a switch connected inside the case to the TIME/DIV knob. Simply turn the TIME/DIV knob fully counterclockwise until you feel the switch toggle.

Now make the measurement in the normal manner. Make sure the MODE switch is in the N position. S4 and S5 may be in any position, although "x1" is preferred for this type measurement. If a logic 1 is present, the entire channel will light; if a logic 0 is present, no LED's will be lighted.

Ni-Cad Battery Recharge The Ni-Cad batteries in the unit should be charged approximately fourteen hours for a full charge. This is done by plugging the unit into the AC adapter and leaving the power switch in the OFF position. Be sure that you never leave the AC adapter plugged into the unit unless the adapter itself is plugged into a power wall socket. Since the Ni-Cad batteries can be used for only approximately 1½ hours before losing their charge, we recommend that when the machine is not in use, the batteries are being recharged.

SERVICE: Should you have a problem with your MS416, it can be returned to MITS for repair. If it is still under warranty, any defective part will be replaced free of charge. The purchaser is responsible for all postage.

NOTE: Before returning the MS416 for repair,

Pack it in a sturdy cardboard container and surround it on all sides with a layer of packing material. You may use shredded newspaper, soft foamed plastic, or excelsior. The packed carton should be neatly sealed with gummed tape and tied with a stout cord. Be sure to tape a letter containing your name and address, a description of the malfunction, and the original invoice to the outside of the carton.

Mail the carton by parcel post or UPS — for extra fast service, ship by air parcel post. Be sure and insure the package.

SHIP TO:

MITS

6324 Linn Ave. N.E.

Albuquerque, New Mexico 87108

All warranties are void if any changes have been made to the basic design of the machine or if the internal workings have been tampered with in any way.